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Research Summary:

Atomic clusters often display novel properties that vary significantly from one size to the next. The objective of my research program is to characterize the magnetic, electrostatic, spectroscopic, and chemical properties cluster systems size, specifically for the purpose of identifying novel, confinement-induced emergent phenomena as well as to pinpoint "magic" clusters having special properties or unusual stability that may serve as building blocks in cluster-assembled materials. We have discovered, for example, that normally non-magnetic metals such as manganese can become magnetic when produced in the form of small clusters. We have the ability to produce molecular beams clusters composed of virtually any element or binary combination of elements from a few atoms and a few hundred atoms, enabling both fundamental in-beam studies and deposition onto substrates for production of thin-film materials under UHV conditions.

Selected Recent Publications:

N. Hosoya, R. Takegami, J. Suzumura, K. Koyasu, K. Miyajima, M. Mitsui, M. B. Knickelbein, S. Yabushita, and A. Nakajima, "Lanthanide Organometallic Sandwich Nanowires: Formation Mechanism," *J. Phys. Chem A* **109**, 9-12 (2005)

K. Miyajima, M.B. Knickelbein and A. Nakajima, "Magnetic Properties of Lanthanide Organometallic Sandwich Complexes Produced In A Molecular Beam," *Polyhedron* **24**, 2341-2345 (2005)

M.B. Knickelbein**,** "Magnetic Moments Of Small Bimetallic Clusters: Co_nMn_m," *Phys. Rev. B* **75**, 014401 (2007)

M.K. Beyer and M.B. Knickelbein, "Electric Deflection Studies of Rhodium Clusters," *J. Chem. Phys.* **126**, 104301 (2007)

M. Qian, S. V. Ong and S. N. Khanna, and M.B. Knickelbein, "Magnetic Endohedral Metallofullerenes with Floppy Interiors," *Phys. Rev. B* **75**, 104424 (2007)

K. Miyajima, S. Yabushita, M. B. Knickelbein, and A. Nakajima, "Stern-Gerlach Experiments of One-Dimensional Metal-Benzene Sandwich Clusters: $M_n(C_6H_6)_m$ (M = Al, Sc, Ti and V)," *J. Am. Chem. Soc.* (in press)